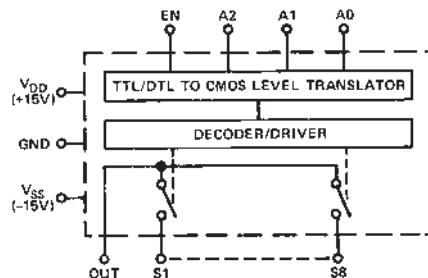


**AD7501/AD7502/AD7503**
**FEATURES**
**DTL/TTL/CMOS Direct Interface**
**Power Dissipation: 30  $\mu$ W**
 **$R_{ON}$ : 170  $\Omega$** 
**Standard 16-Lead DIPs and 20-Terminal Surface  
Mount Packages**
**FUNCTIONAL BLOCK DIAGRAM**
**AD7501/AD7503**

**GENERAL DESCRIPTION**

The AD7501 and AD7503 are monolithic CMOS, 8-channel analog multiplexers which switch one of eight inputs to a common output, depending on the state of three binary address lines and an "enable" input. The AD7503 is identical to the AD7501 except its "enable" logic is inverted. All digital inputs are TTL/DTL and CMOS logic compatible.

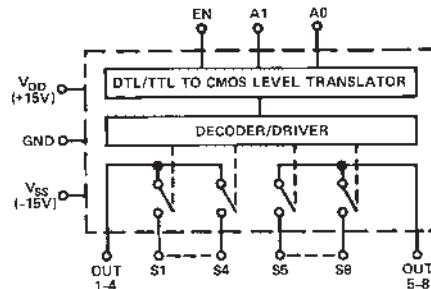
The AD7502 is a monolithic CMOS dual 4-channel analog multiplexer. Depending on the state of two binary address inputs and an "enable," it switches two output buses to two of eight inputs.

**Truth Tables**
**AD7501**

<b>A<sub>2</sub></b>	<b>A<sub>1</sub></b>	<b>A<sub>0</sub></b>	<b>EN</b>	<b>"ON"</b>
0	0	0	1	1
0	0	1	1	2
0	1	0	1	3
0	1	1	1	4
1	0	0	1	5
1	0	1	1	6
1	1	0	1	7
1	1	1	1	8
X	X	X	0	None

**AD7503**

<b>A<sub>2</sub></b>	<b>A<sub>1</sub></b>	<b>A<sub>0</sub></b>	<b>EN</b>	<b>"ON"</b>
0	0	0	0	1
0	0	1	0	2
0	1	0	0	3
0	1	1	0	4
1	0	0	0	5
1	0	1	0	6
1	1	0	0	7
1	1	1	0	8
X	X	X	1	None

**AD7502**

**AD7502**

<b>A<sub>1</sub></b>	<b>A<sub>0</sub></b>	<b>EN</b>	<b>"ON"</b>
0	0	1	1 & 5
0	1	1	2 & 6
1	0	1	3 & 7
1	1	1	4 & 8
X	X	0	None

**REV. B**

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# AD7501/AD7502/AD7503—SPECIFICATIONS (V<sub>DD</sub> = +15 V, V<sub>SS</sub> = -15 V unless otherwise noted.)

Parameter	Version <sup>1</sup>	Switch Condition	@ +25°C		Over Specified Temperature Range		Test Conditions
			AD7501, AD7503	AD7502	AD7501, AD7503	AD7502	
ANALOG SWITCH							
R <sub>ON</sub>	All	ON	170 Ω typ, 300 Ω max	170 Ω typ, 300 Ω max			
R <sub>ON</sub> vs. V <sub>S</sub>	All	ON	20% typ	20% typ			-10 V ≤ V <sub>S</sub> ≤ +10 V
R <sub>ON</sub> vs. Temperature	All	ON	0.5%/°C typ	0.5%/°C typ			I <sub>S</sub> = 1.0 mA
ΔR <sub>ON</sub> Between Switches	All	ON	4% typ	4% typ			V <sub>S</sub> = 0 V, I <sub>S</sub> = 1.0 mA
R <sub>ON</sub> vs. Temperature Between Switches	All	ON	±0.01%/°C	±0.01%/°C			
I <sub>S</sub>	K	OFF	0.2 nA typ, 2 nA max	0.2 nA typ, 2 nA max	50 nA max	50 nA max	V <sub>S</sub> = -10 V, V <sub>OUT</sub> = +10 V and V <sub>S</sub> = +10 V, V <sub>OUT</sub> = -10 V
I <sub>S</sub>	S	OFF	0.5 nA max	0.5 nA max	50 nA max	50 nA max	V <sub>S</sub> = -10 V, V <sub>OUT</sub> = +10 V and V <sub>S</sub> = +10 V, V <sub>OUT</sub> = -10 V
I <sub>OUT</sub>	K	OFF	1 nA typ, 10 nA max	0.6 nA typ, 5 nA max	250 nA max	125 nA max	AD7501/02: Enable LOW
	S	OFF	5 nA max	3 nA max	250 nA max	125 nA max	AD7503: Enable HIGH
I <sub>OUT</sub> - I <sub>S</sub>	K	ON	12 nA max	7 nA max	300 nA max	175 nA max	V <sub>S</sub> = 0
		S	5.5 nA max	3.5 nA max	300 nA max	175 nA max	
DIGITAL CONTROL							
V <sub>INL</sub>	All				0.8 V max	0.8 V max	
V <sub>VNH</sub>	All				2.4 V min	2.4 V min	
I <sub>INL</sub> or I <sub>VNH</sub>	All						
C <sub>IN</sub>	All						
DYNAMIC CHARACTERISTICS							
t <sub>ON</sub>	All		0.8 μs typ	0.8 μs typ			
t <sub>OFF</sub>	All		0.8 μs typ	0.8 μs typ			
C <sub>S</sub>	All	OFF	5 pF typ	5 pF typ			
C <sub>OUT</sub>	All	OFF	30 pF typ	15 pF typ			
C <sub>SOUT</sub>	All	OFF	0.5 pF typ	0.5 pF typ			
C <sub>SS</sub> Between Any Two Switches	All	OFF	0.5 pF typ	0.5 pF typ			
POWER SUPPLY							
I <sub>DD</sub>	All		500 μA max	500 μA max	500 μA max	500 μA max	All Digital Inputs Low
I <sub>SS</sub>	All		500 μA max	500 μA max	500 μA max	500 μA max	All Digital Inputs High
I <sub>DD</sub>	All		800 μA max	800 μA max	800 μA max	800 μA max	
I <sub>SS</sub>	All		800 μA max	800 μA max	800 μA max	800 μA max	

## NOTES

<sup>1</sup>KN version specified for 0°C to +70°C, KQ version for -25°C to +85°C; and SQ, SE versions for -55°C to +125°C.

Specifications subject to change without notice.

## ABSOLUTE MAXIMUM RATINGS

(T<sub>A</sub> = +25°C unless otherwise noted)

V <sub>DD</sub> to GND	.....	+17 V
V <sub>SS</sub> to GND	.....	-17 V
V Between Any Switch Terminals <sup>1</sup>	.....	25 V
Digital Input Voltage Range	.....	V <sub>DD</sub> to GND
Overvoltage at V <sub>OUT</sub> (V <sub>S</sub> )	.....	V <sub>SS</sub> , V <sub>DD</sub>
Switch Current (I <sub>S</sub> , Continuous One Channel)	.....	35 mA
Switch Current (I <sub>S</sub> , Surge One Channel)	.....	
1 ms Duration, 10% Duty Cycle	.....	50 mA
Power Dissipation (Any Package)	.....	
Up to +75°C	.....	450 mW
Derates above +75°C by	.....	6 mW/°C

## Operating Temperature

Commercial (KN Version)	.....	0°C to +70°C
Industrial (KQ Version)	.....	-25°C to +85°C
Extended (SQ, SE Versions)	.....	-55°C to +125°C
Storage Temperature	.....	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	.....	+300°C

## CAUTION

<sup>1</sup>Do not apply voltages higher than V<sub>DD</sub> and V<sub>SS</sub> to any other terminal, especially when V<sub>SS</sub> = V<sub>DD</sub> = 0 V all other pins should be at 0 V.

<sup>2</sup>The digital control inputs are diode protected; however, permanent damage may occur on unconnected units under high energy electrostatic fields. Keep unused units in conductive foam at all times.

## CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD7501, AD7502, and AD7503 feature proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



## ORDERING GUIDE

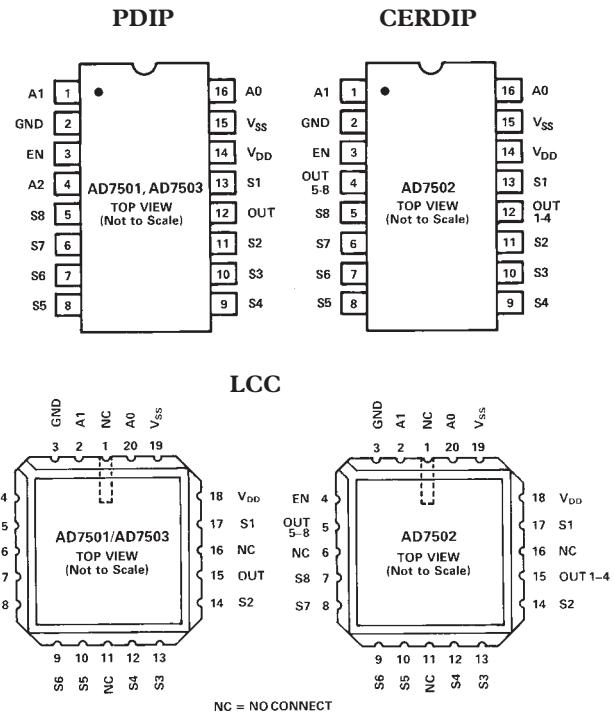
Model <sup>1</sup>	Temperature Range	Package Options <sup>2</sup>
AD7501KN	0°C to +70°C	N-16
AD7501KQ	-25°C to +85°C	Q-16
AD7501SQ	-55°C to +125°C	Q-16
AD7501SE	-55°C to +125°C	E-20A
AD7502KN	0°C to +70°C	N-16
AD7502KQ	-25°C to +85°C	Q-16
AD7502SQ	-55°C to +125°C	Q-16
AD7502SE	-55°C to +125°C	E-20A
AD7503KN	0°C to +70°C	N-16
AD7503KQ	-25°C to +85°C	Q-16
AD7503SQ	-55°C to +125°C	Q-16
AD7503SE	-55°C to +125°C	E-20A

### NOTES

<sup>1</sup>To order MIL-STD-883, Class B processed parts, add/883B to part number. See the Analog Devices' 1990 Military Databook for military data sheet.

<sup>2</sup>E = LCC; N = PDIP; Q = CERDIP.

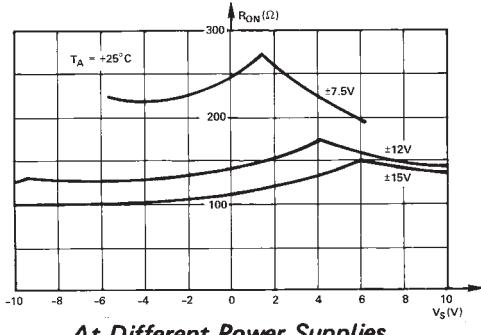
## PIN CONFIGURATIONS



NC = NO CONNECT

## Typical Performance Characteristics

### 1. $R_{ON}$ Versus $V_S$



At Different Power Supplies

Figure 1a.  $R_{ON}$  vs.  $V_S$  At Different Power Supplies

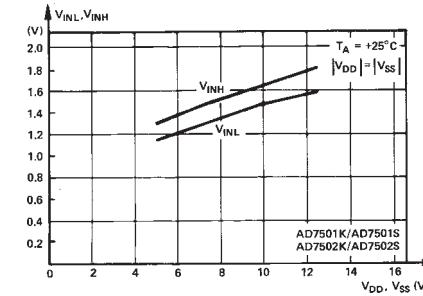


Figure 2a. Digital Threshold Voltage ( $V_{INH}$ ,  $V_{INL}$ ) vs. Power Supply

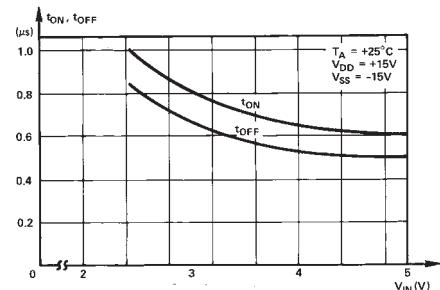


Figure 3.  $t_{ON}$ ,  $t_{OFF}$  vs. Digital Input Voltage

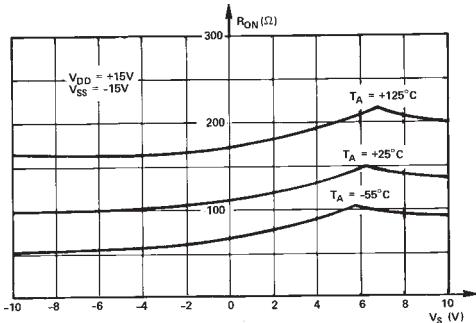


Figure 1b.  $R_{ON}$  vs.  $V_S$  At Different Temperatures

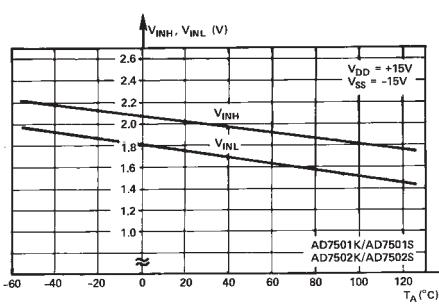


Figure 2b. Digital Threshold Voltage ( $V_{INH}$ ,  $V_{INL}$ ) vs. Temperature

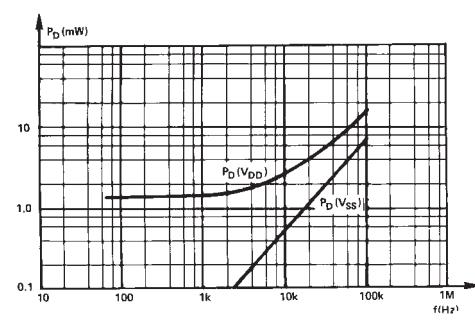
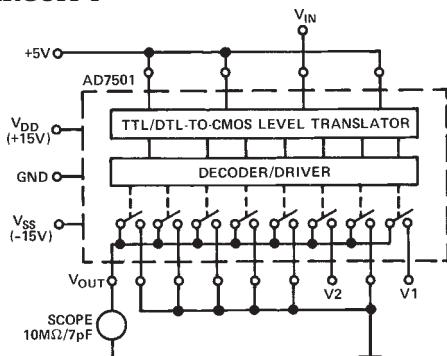


Figure 4. Power Dissipation vs. Logic Frequency (50% Duty Cycle)

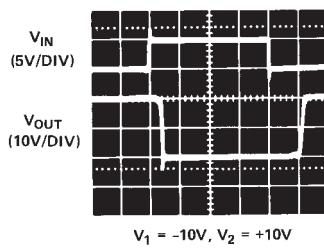
# AD7501/AD7502/AD7503

## TYPICAL SWITCHING CHARACTERISTICS

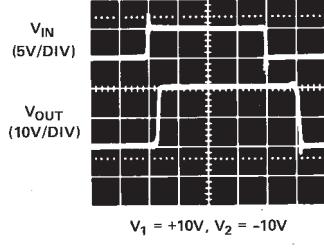
### TEST CIRCUIT 1



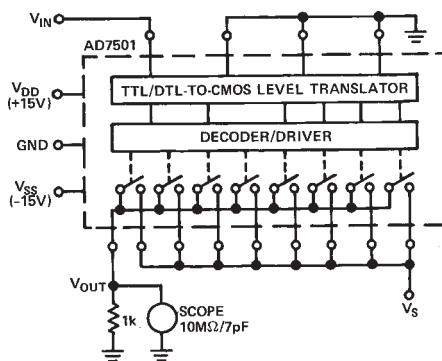
1  $\mu$ s/DIV



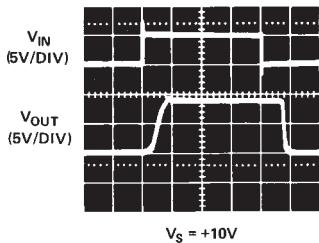
1  $\mu$ s/DIV



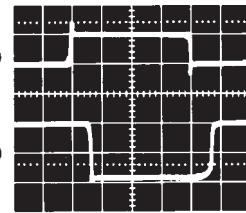
### TEST CIRCUIT 2



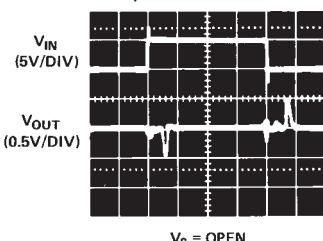
1  $\mu$ s/DIV



1  $\mu$ s/DIV



1  $\mu$ s/DIV

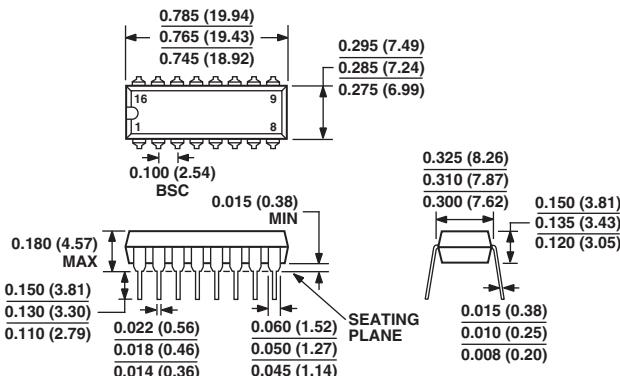


### OUTLINE DIMENSIONS

#### 16-Lead Plastic Dual In-Line Package [PDIP]

(N-16)

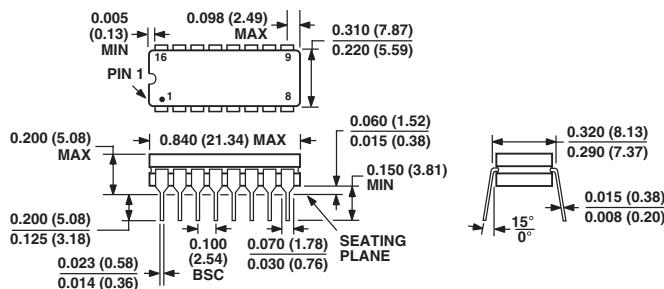
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MO-095AC  
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS  
(IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR  
REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

#### 16-Lead Ceramic Dual In-Line Package [CERDIP] (Q-16)

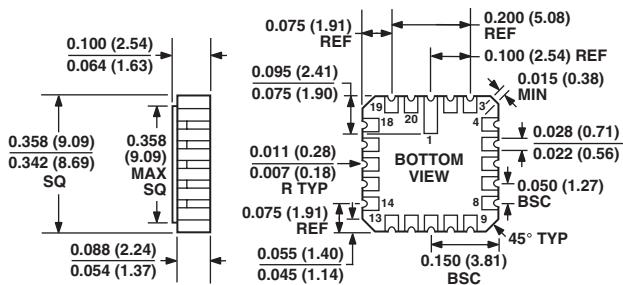
Dimensions shown in inches and (millimeters)



CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS  
(IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR  
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#### 20-Terminal Ceramic Leadless Chip Carrier [LCC] (E-20A)

Dimensions shown in inches and (millimeters)



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(IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR  
REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN